


Applications of Physiological Variability Analyzer Software



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Medical instruments based on impedance and photo plethysmographic techniques

- ICVG,
- AnuPhoto Rheograph,
- Medical Analyzer,
- Peripheral Pulse Analyzer (single channel),
- Peripheral Pulse analyzer (three channel),
- Cardiac Output Monitor etc.

These instruments has individual software for data acquisition, processing and analysis.

Problem

- Software maintenance/ upgradation issue
- Data portability issue

Solution

Generalized Software named “Physiological Variability Analyzer”

Physiological Variability Analyzer Software



This has two parts

- for acquisition (Bio-signal Acquisition System)
- for processing and analysis (Physiological Variability Analyzer)

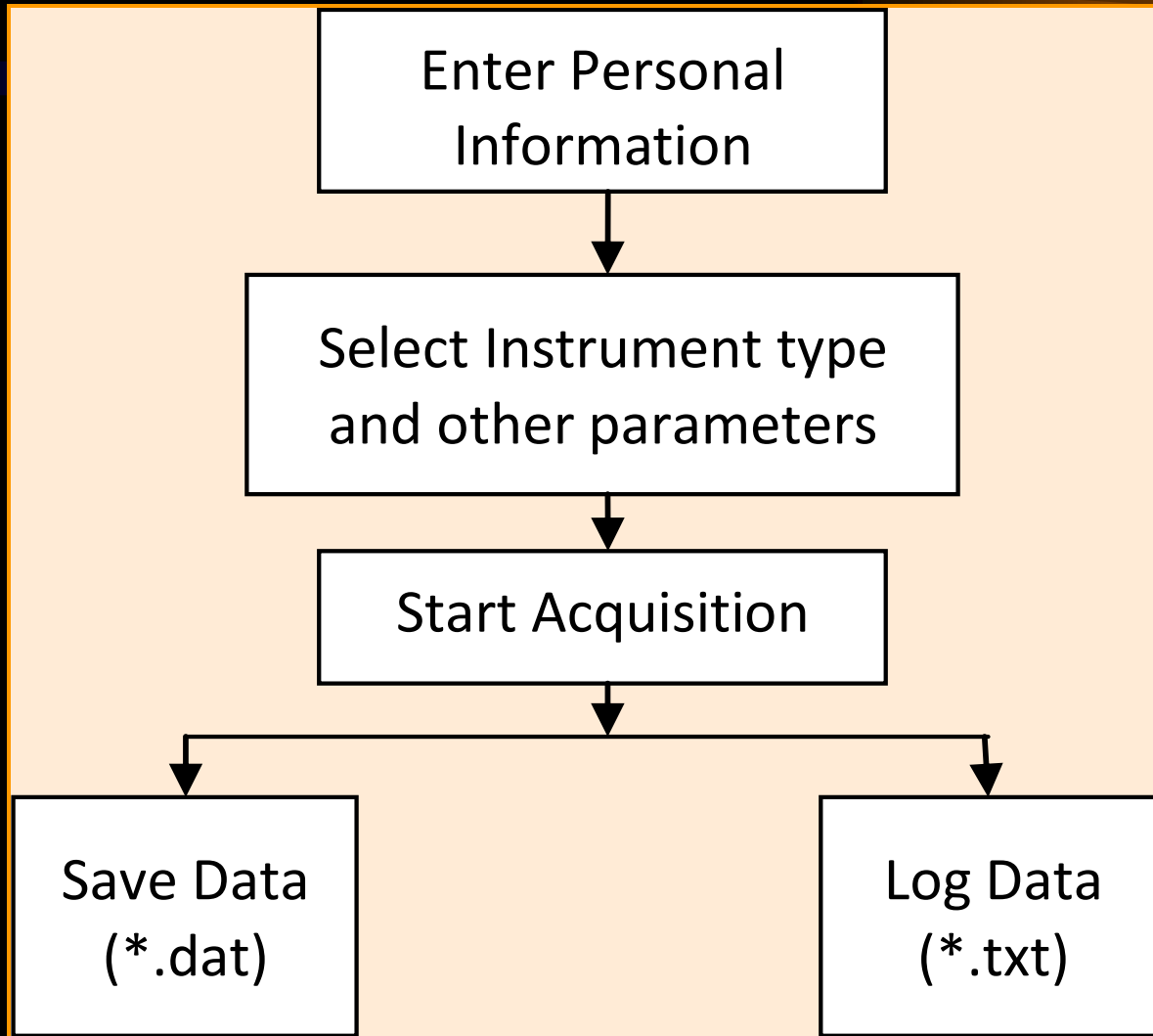
Features of Generalized Software

- Acquisition of biological signal from any of the medical instruments developed by BARC.
- For post processing, load any data file acquired from any of the above instruments.
- Flexibility of selecting the signals for variability study.
- Study of the standard as well as user defined physiological variabilities such as HRV, BFV, MI, Interrelation between two signals etc.

Features of Generalized Software (cont...)

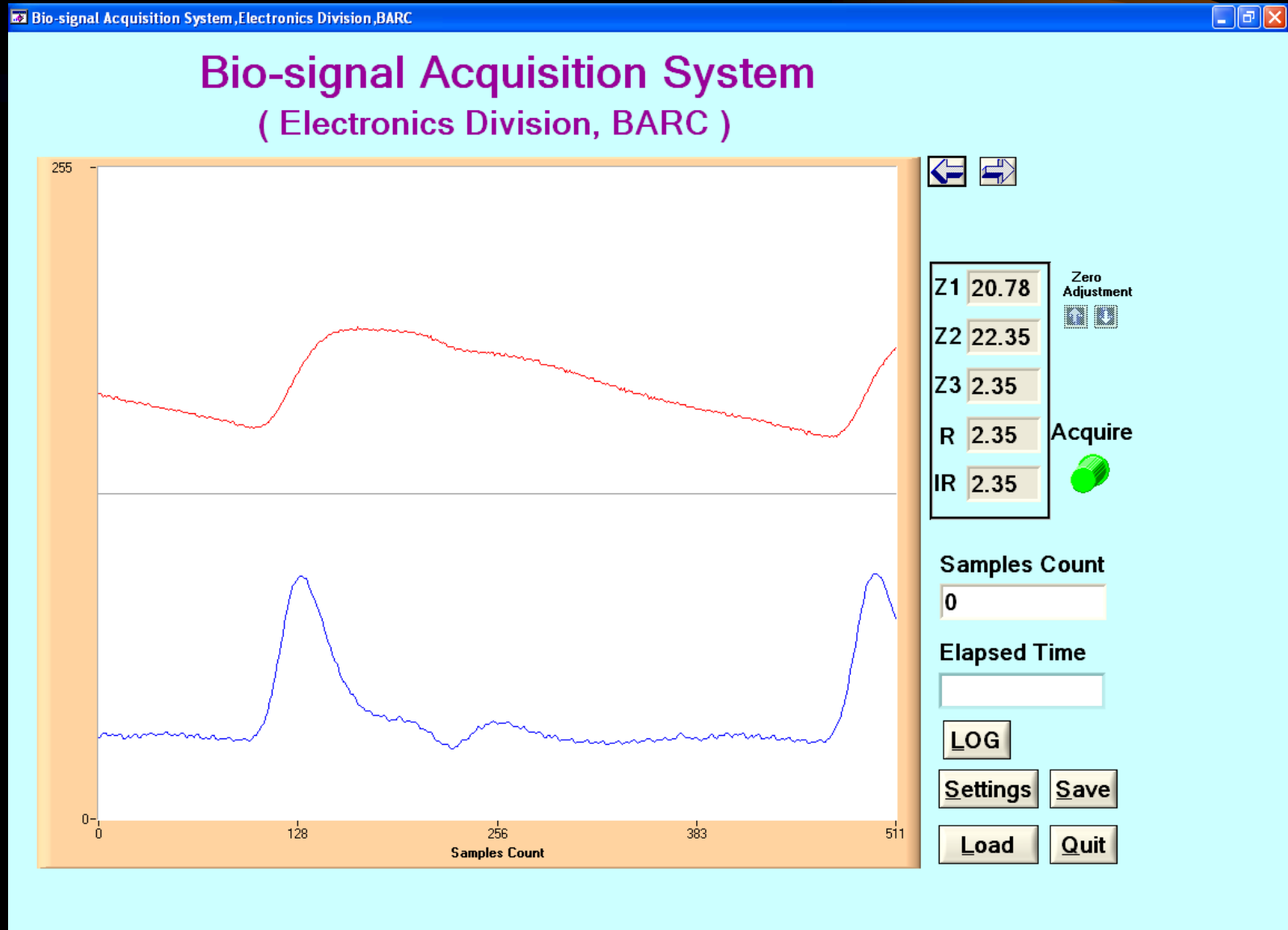
- Computation of time domain, frequency domain and non-linear variability parameters.
- Facility to export above parameters in text (ASCII) and/or excel format for further analysis.
- Hard copy option for the processed data (in time and frequency domain) and consolidated view of selected variabilities.
- Facility to load raw data from the standard ASCII file from any instruments other than that of BARC.
- Easy upgradability.

Flow Chart for Acquisition Software: Bio-signal Acquisition System



Acquisition Software: Bio-signal Acquisition System

Main Panel



Acquisition Software: Bio-signal Acquisition System

Settings Panel

Settings [Min] [Max] [Close]

PERSONAL INFORMATION

Name

Age

Gender male Female

Diseases

ADDRESS

TELEPHONE

REFREE NAME

REFREE TEL. NO.

REMARK

Project Id **LEAD**
LA
CH

COM PORT

Acq Time

Sampling Rate

Drug Usage BI-
AI-

Select ADC

- SDC0 - PL1 27
- ADC1 - FL1.28
- SDC2 - PL1 29
- ADC3 - FL1.30
- ✓ SDC4 - PL1 31 DIR
- ✓ ADC5 - FL1.32 DIR
- SDC6 - FL1.33
- ADC7 - FL1.34
- SDC8 - PL2 27
- ADC9 - FL2.28
- SDC10 - PL2 29
- ADC11 - FL2.30
- SDC12 - PL2 31
- ADC13 - FL2.32
- SDC14 - PL2 33
- ADC15 - FL2.34

Select Gain

(Slider between 1/2 and 2)

Select Instrument

- VarAna(E) -
- Varana(P) -
- PPA -
- IDS -
- Others -

Acquisition Software: Bio-signal Acquisition System

Facility for defining signals in new instrument

Select ADC

- ADC0- PL1.27
- ✓ ADC1- PL1.28
- ADC2- PL1.29
- ADC3- PL1.30
- ADC4- PL1.31
- ADC5- PL1.32
- ADC6- PL1.33
- ADC7- PL1.34
- ADC8- PL2.27
- ADC9- PL2.28
- ADC10- PL2.29
- ADC11- PL2.30
- ADC12- PL2.31
- ADC13- PL2.32
- ADC14- PL2.33
- ADC15- PL2.34

Enter Signal Name

Enter Signal Name

DelZ

OK

Varana[P]-

PPA-

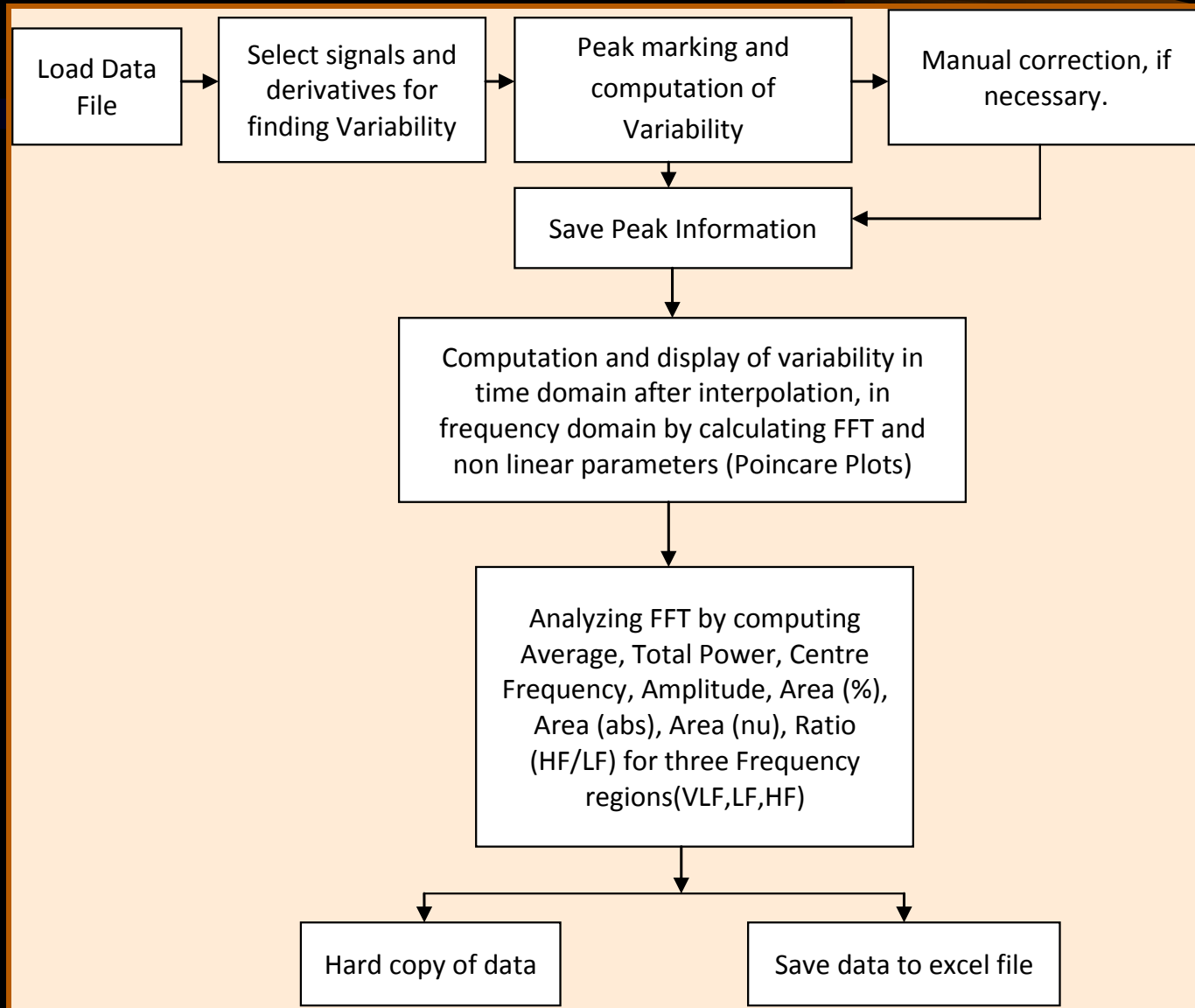
IDS-

Others-

OK

Processing Software: Physiological Variability Analyzer

Flow Chart



Processing Software: Physiological Variability Analyzer

Main Panel

Processing software

Physiological Variability Analyzer

(Electronics Division, BARC)

Load d:\Projects\Processing_SW\VaranaP_data\Ashok_09-07-2010\CONTROL_Ashok_processed_09-07-201010-48-00_BI_01_RA.dat

Select the raw signals

- dIR
- DIR

Select the raw signal to find HRV

- dIR
- DIR

Select the Variability Parameters

Signal	BFV	MI	DIFF
dIR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	DIR
DIR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	dIR

Peak to Peak 200

Search Width 500

Peak-Base count 45

Max - CC count 750

Neighbouring Count 20

MinF 5 (*0.004)

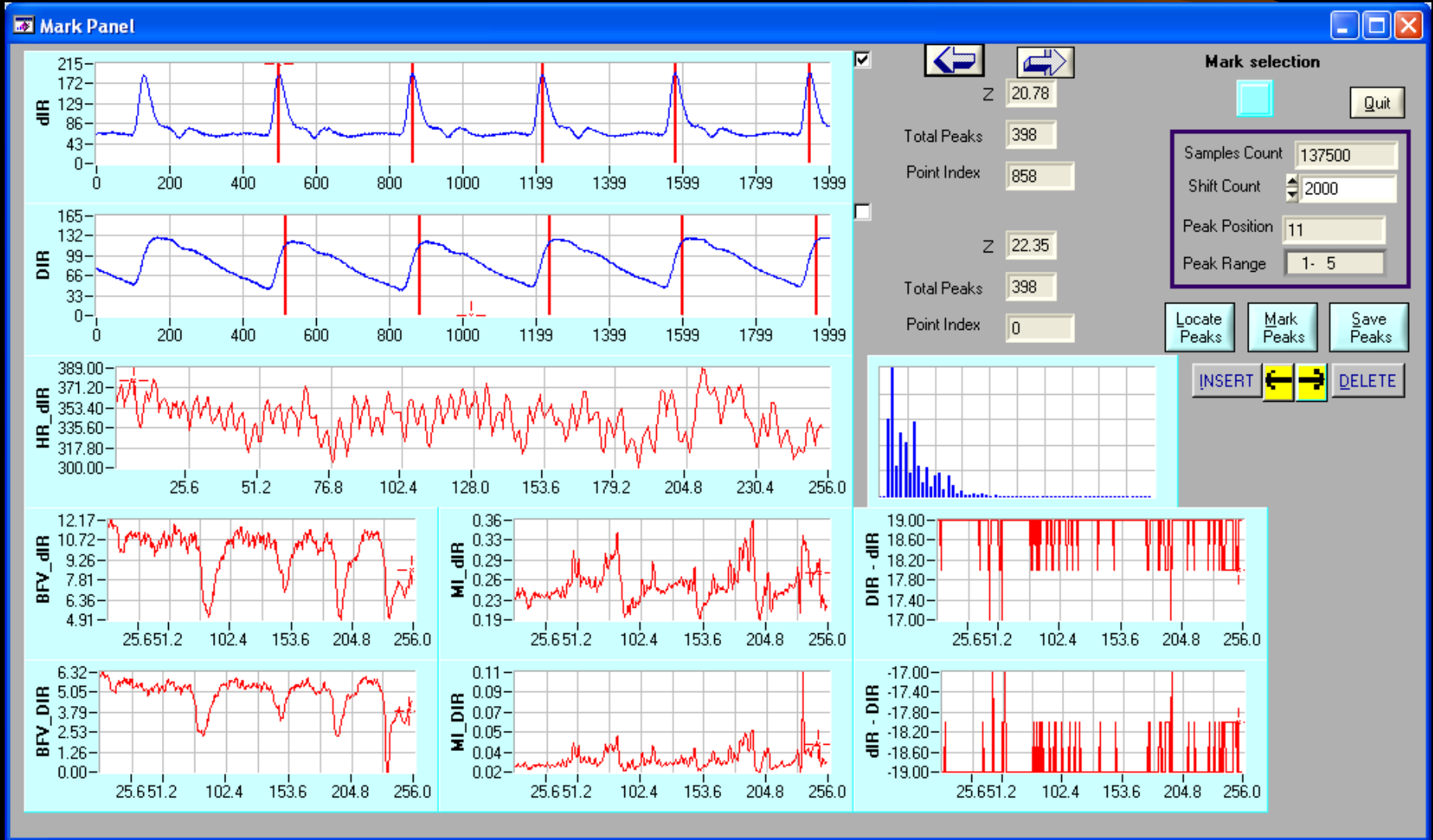
Instrument used...

VarAnaE VarAnaP PPA IDS Others

Selection Panel **Display Panel** **Quit**

Processing Software: Physiological Variability Analyzer

Selection Panel



Processing Software: Physiological Variability Analyzer

Main Panel

Processing software

Physiological Variability Analyzer

(Electronics Division, BARC)

Load d:\Projects\Processing_SW\VaranaP_data\Ashok_09-07-2010\CONTROL_Ashok_processed_09-07-201010-48-00_BI_01_RA.dat

Select the raw signals

- dIR
- DIR

Select the raw signal to find HRV

- dIR
- DIR

Select the Variability Parameters

Signal	BFV	MI	DIFF
dIR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	DIR
DIR	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	dIR

Peak to Peak

Search Width

Peak-Base count

Max - CC count

Neighbouring Count

MinF
(*0.004)

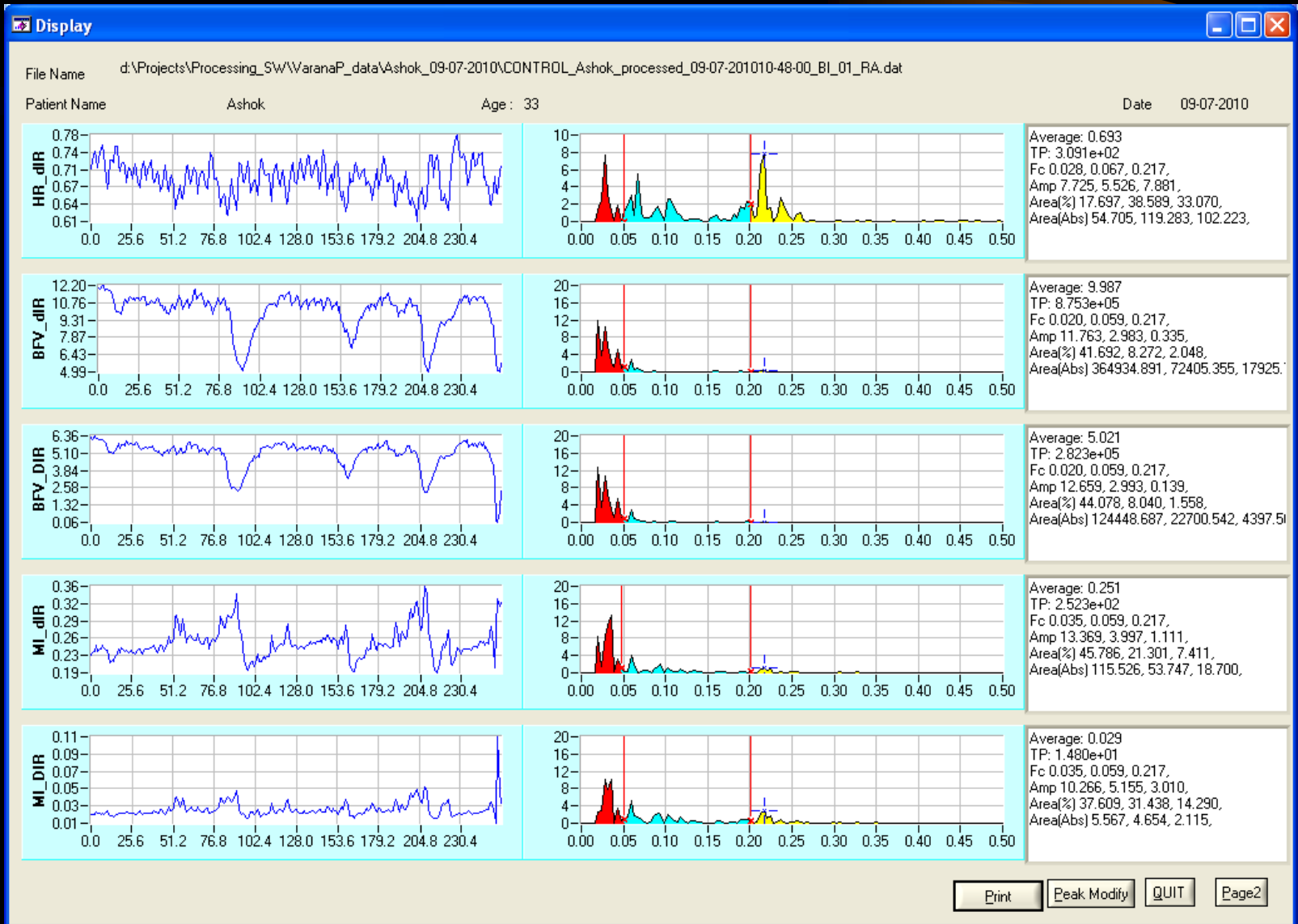
Instrument used...

VarAnaE VarAnaP PPA IDS Others

Selection Panel **Display Panel** **Quit**

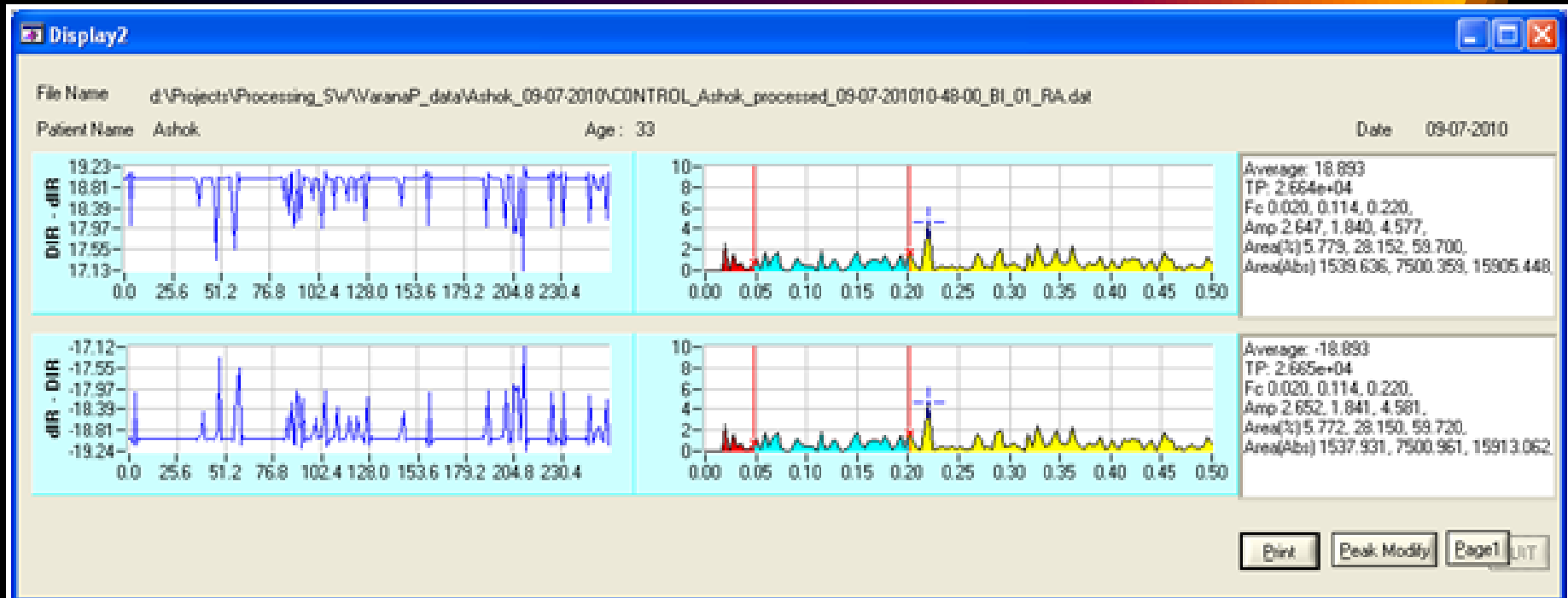
Processing Software: Physiological Variability Analyzer

Display Panel



Processing Software: Physiological Variability Analyzer

Display Panel – 2nd page





***APPLICATIONS OF
PHYSIOLOGICAL VARIABILITY
ANALYZER***

Clinical Implication of Heart Rate Variability

K.K. Deepak & Ashok K Jaryal, Deptt of Physiology, AIIMS, New Delhi – 110029

- **A Predictor of Myocardial Infarction**
- **As a Marker for Sudden Infant Death Syndrome (SIDS)**
- **As a Risk Marker for Sudden Unexplained Death in Epilepsy (SUDEP)**
- **As a Marker for Arrhythmia**
- **A tool for Classification of Heart Disease**
- **As an Indicator of Hemodynamic Crisis**
- **As a Tool for Monitoring ANS During Anesthesia**
- **As a Parameter to Predict Time-to-Death**
- **As a Suitable Parameter for Telemedicine**
- **As an indicator of inflammation**
- **As a Useful Parameter for Biofeedback Intervention**

Clinical Applications

- Heart Rate Variability: A Potential Indicator of Psychophysiological Stress** Amitabh Dube, Ashok Gupta, Vineet Sinha[#] & K.K. Deepak*, Deptt of Physiology, S.M.S. Medical College & Hospital, Jaipur, [#]BARC, Mumbai – 400 085, *AIIMS, New Delhi - 110029

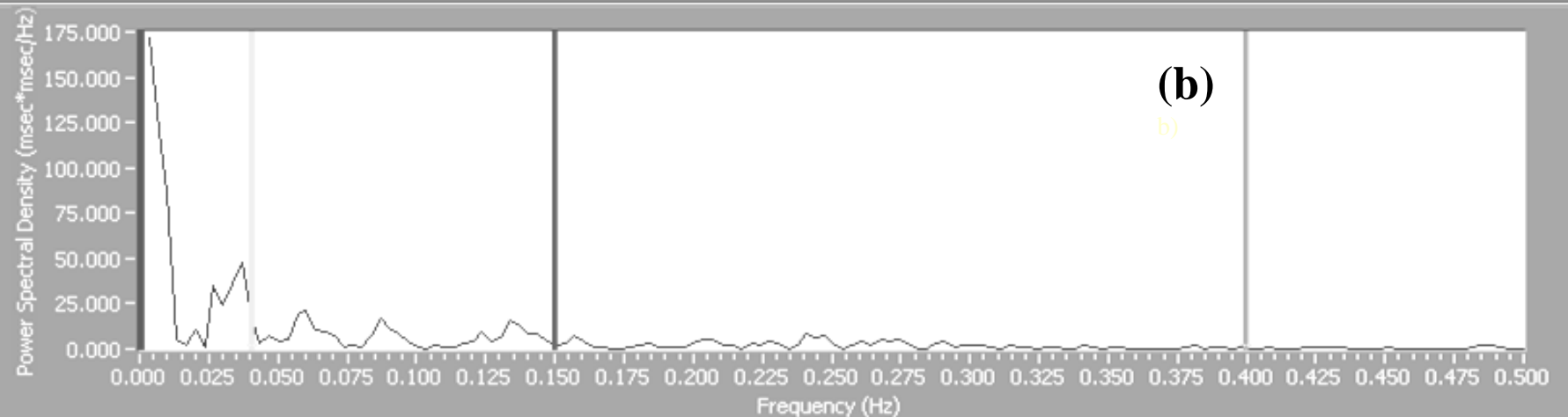
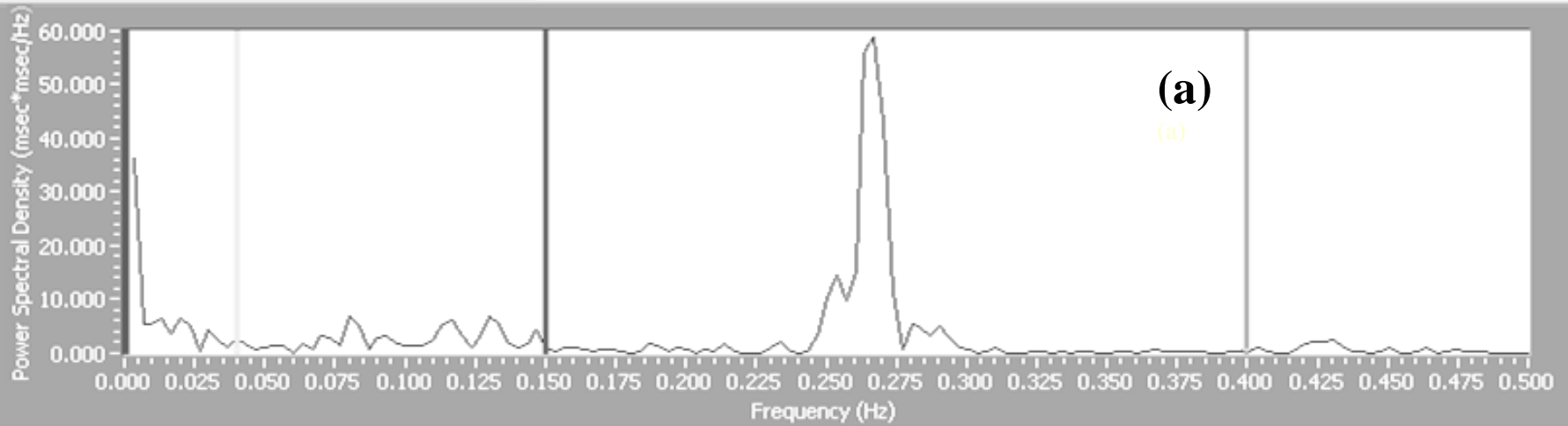


Figure shows PSD in a control subject (a) before and (b) during mental arithmetic. Increase in LF amplitude and decrease in HF amplitude can evidently be seen during mental stress.

Clinical Applications

- **Variability Studies and Disease Characterization, Smitha Bhat, K. S. Bhat, Shilpa D'sa & Roopa, Deptt of Medicine, FMMC, Mangalore**

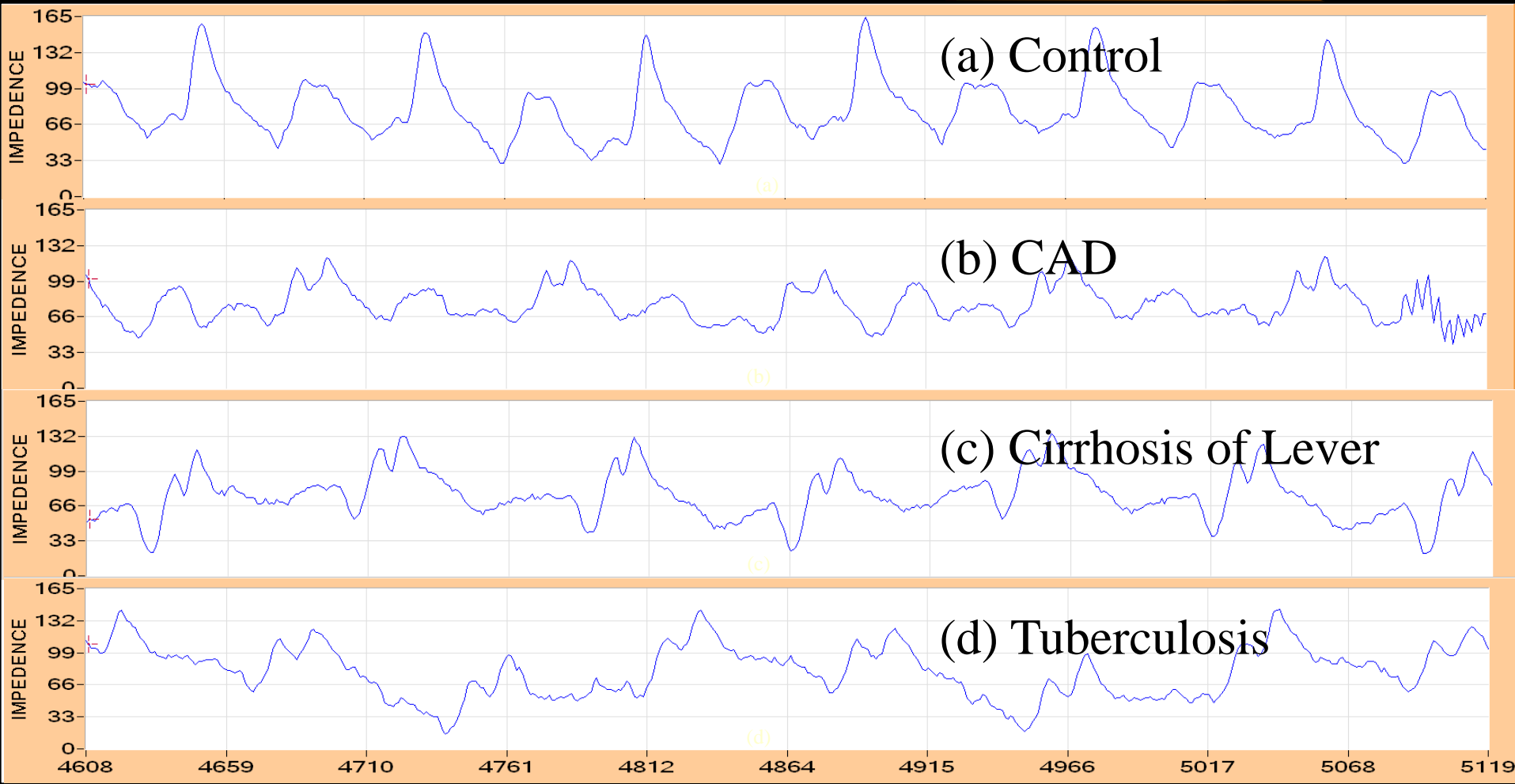


Figure shows different morphological patterns in (a) control and patients with (b) coronary artery disease, (c) cirrhosis of liver and (d) tuberculosis.

Clinical Applications

- **Fundamental Research in Homoeopathy Using Physiological Variability**, Nirupama Mishra¹, KC Muraleedharan², Gautam Rakshit³, AS Paranjpe⁴, Ramesh S Bawaskar², Sujatha³ and C Nayak⁵, ¹National Institute of Homoeopathy, Kolkata; ²RRI, CCRH, Belapur, Navi-Mumbai; ³RRI, CCRH, Bhubaneswar; ⁴BARC, Mumbai (Retired); ⁵CCRH, Department of Ayush, New Delhi

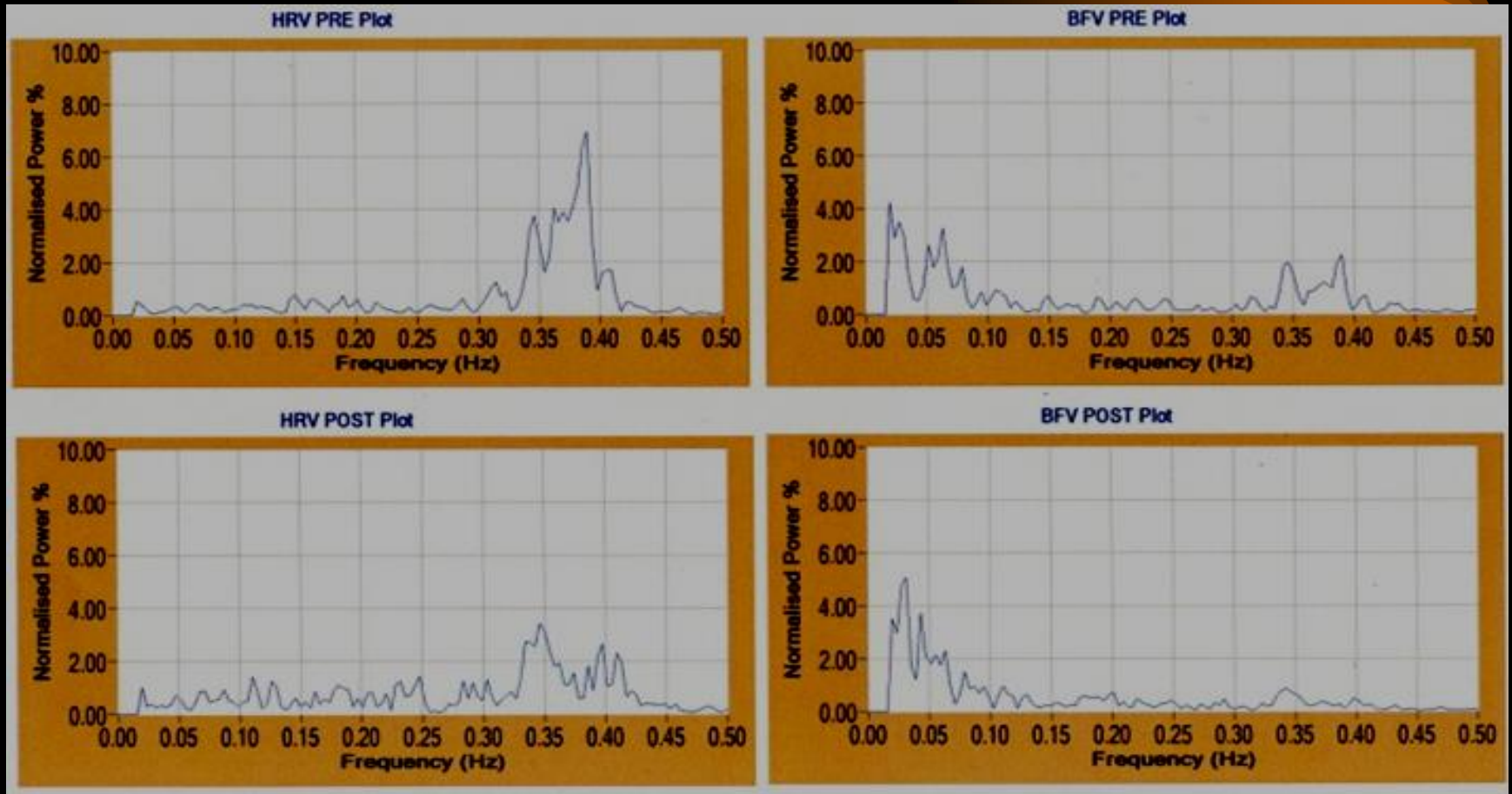
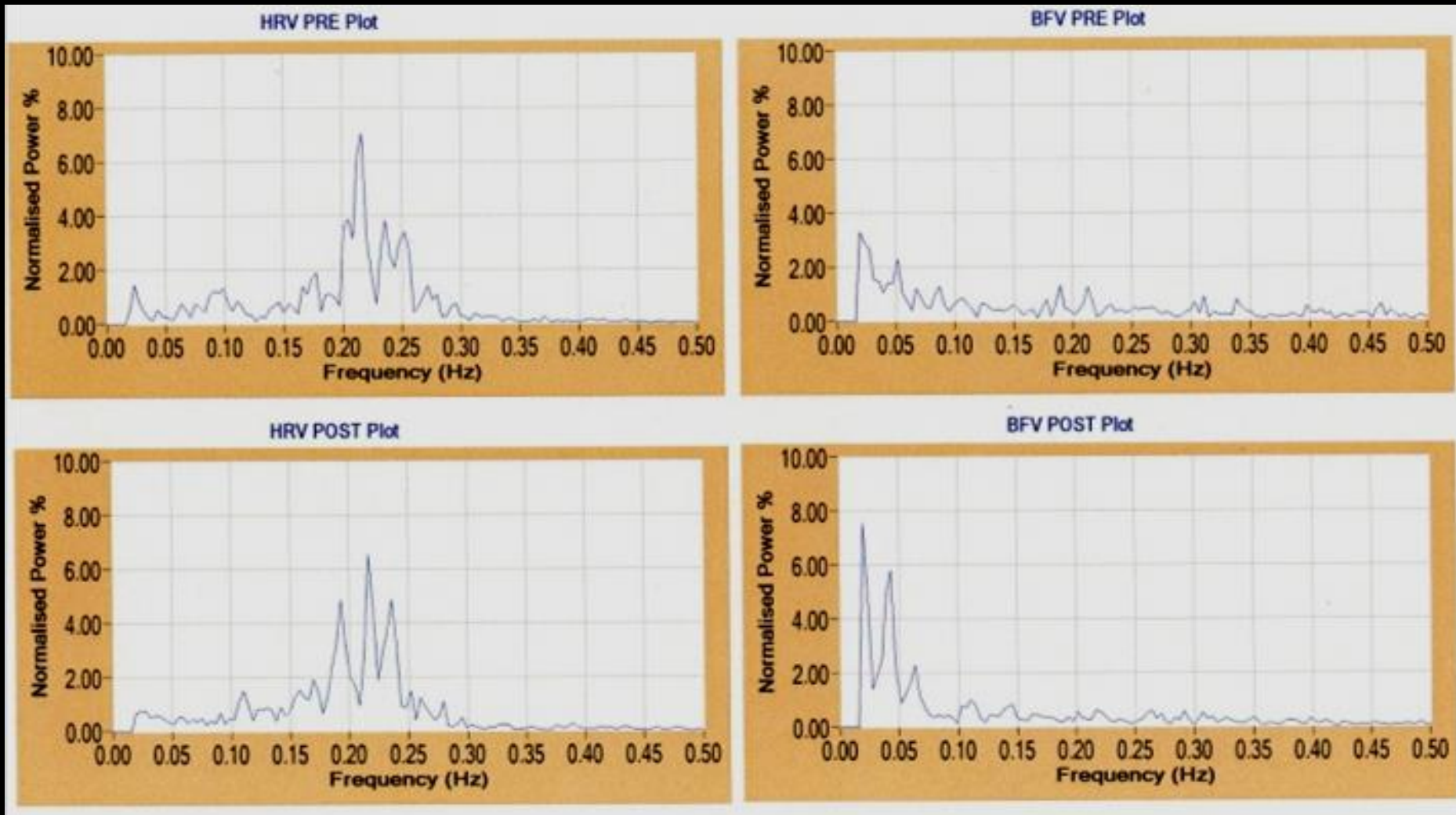


Figure shows spectrum with *Aconite 30*. HF peak is decreased more than 50% in HRV as well as BFV. Thus there is H- response in HRV and BFV.

Clinical Applications



*Figure shows pre (top) and post (bottom) intervention HRV (left) and BFV (right) spectrum with **Aconite 1M**. VLF peak is increased more than 100% in BFV. Thus there is V+ response in BFV. There is no significant change in HRV spectrum.*

Clinical Applications

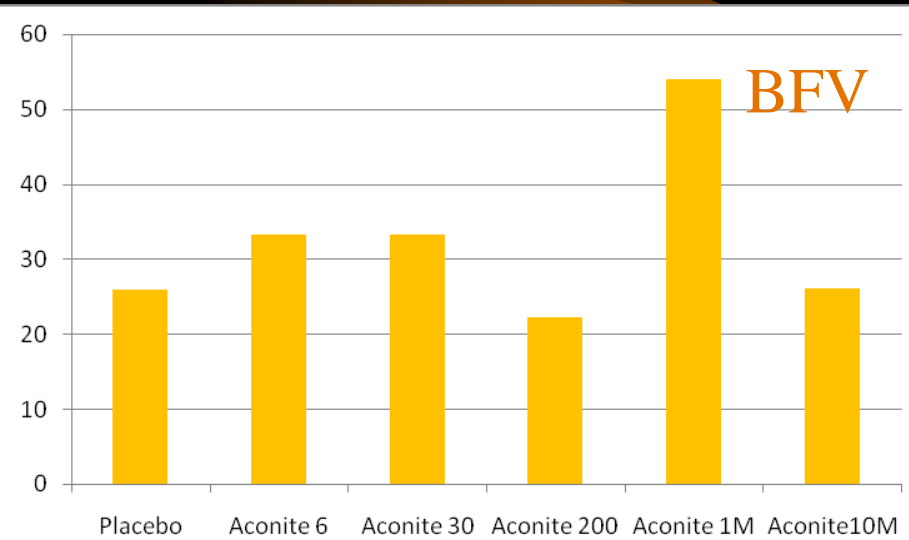
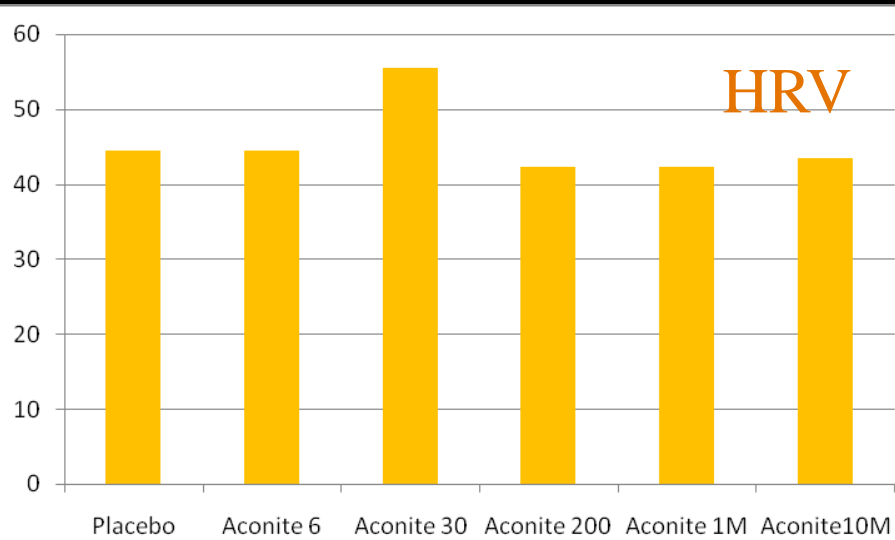


Fig shows Percentage Response (a) in HRV and (b) in BFV with different potencies of Aconite. It is observed that potency 30 produces a discernible response in HRV and 1M produces a discernible response in BFV.

Clinical Applications

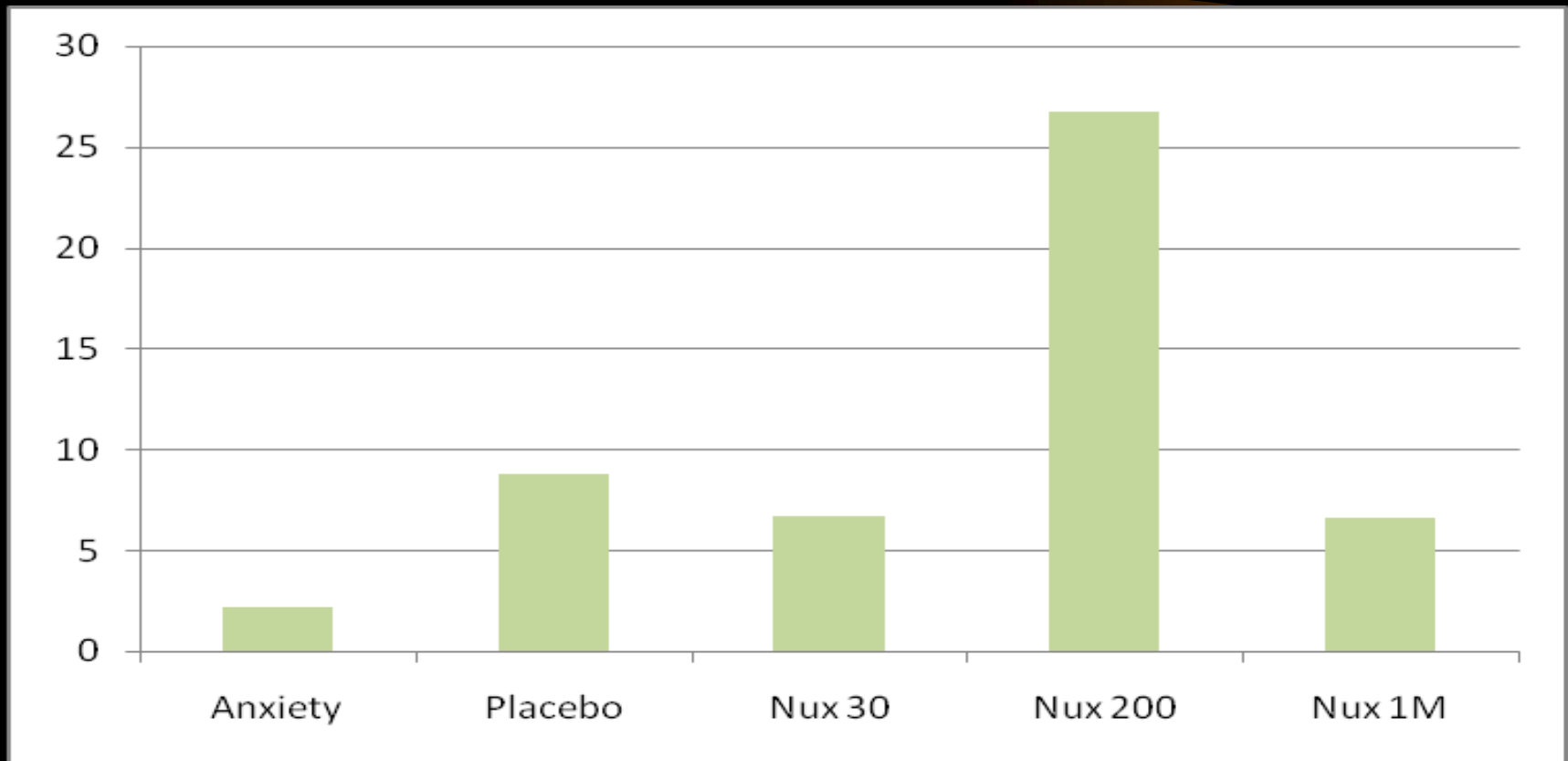


Fig. shows Percentage Response in HRV with different potencies of Nux Vomica. Distinct peak for Nux Vomica-200 can evidently be seen.

Clinical Applications

- Fundamental Research in Homoeopathy : Experiments with Sulphur, *Srinath Rao, Prasanna Kumar, Sandeep Kumar Ram, Vivek Sakthidjaran and Mullei*, FMHMC, Mangalore

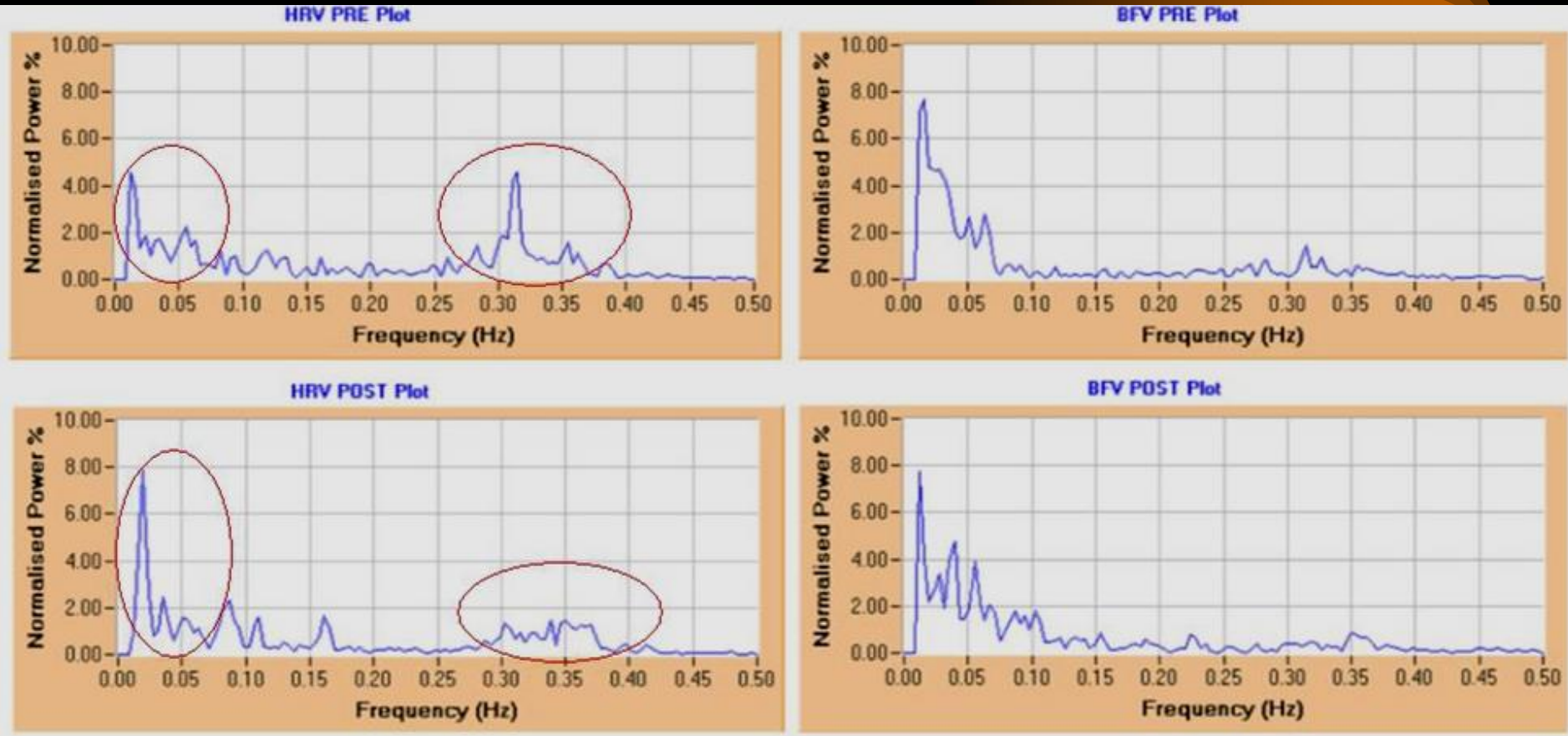


Fig. shows HRV and BFV spectra before and after administration of Sulphur 30 in a control subject. More than 100% increase in VLF peak and 50% decrease in HF can evidently be seen in HRV post intervention.

Clinical Applications

- Identifying Tridosha in Pulse Morphology for Disease Characterisation
 - *Prasanna Kelkar¹, Sunil Karamchandani² and Sameer K. Jindal³*; ¹Ayurved Hitaishani Trust & Samshodhan Kendra, Thane; ²Ph D Student, Electrical Engineering Deptt., IIT Mumbai; ³Sanjeevani Polyclinic, Navi Mumbai
- **“Strength of the HF peak may have inverse relation with the level of Vata element and similarly LF & VLF may have inverse relations with Kapha & Pitta levels in the body”**

Clinical Applications

- **Co-variance in Heart Rate Variability and Blood Pressure Variability**
 - **K.K. Deepak & Ashok K Jaryal**, Deptt of Physiology, AIIMS, New Delhi – 110029
- **Myocardial Infarction and Heart Rate Variability**
 - **Ashok K Jaryal, Kushal Madan* & KK Deepak**, Deptt of Physiology, AIIMS, New Delhi, *Sir Ganga Ram Hospital, New Delhi
- **Evaluation of Peripheral Pulse Analyzer from Ayurvedic View Point**
 - *P.M. Varier, K. Muraleedharan, T.S. Muraleedharan, T.P. Udayakumari and A.V. Sudheer*; Arya Vaidya Sala, Kottakkal.

Conclusion

- It is a diagnostic tool with unlimited usage. Software is general purpose and can be used to find variability of any recorded parameter.
- It has shown usage in different medical fields viz. Homeopathy, Ayurvedic, Disease Characterization etc.
- Research Collaboration Projects are welcome in the field of different variability studies and can get research grant from BRNS, DAE.



Thank You!